



### Why is it important?

Zeolites are porous crystals that can act as storage cells until they are heated and release their contents. Zeolites (zeo lithos, "the rock that boils") are a \$2-billion-a-year component of the world's trillion-dollar chemical processing industry worldwide. Virtually all of the world's gasoline is produced or upgraded using zeolites. Even a 1-percent improvement in the yield of gasoline from oil zeolites could have an economic impact exceeding tens of millions of dollars. However, gravitational effects on Earth restrict zeolites to the size of bacteria, thus limiting studies of their structures.

### What is NASA doing?

The Center for Advanced Microgravity Materials Processing (CAMMP), a NASA-sponsored Commercial Space Center, is working to improve zeolite materials by using the microgravity of Earth orbit. Flights in 1992, 1993, and 1995 grew larger, higher quality zeolites than were possible on Earth. Studies continue with a Zeolite Crystal Growth Furnace Unit aboard the ISS and a similar unit on the STS-107 research mission in 2003.

### What are the benefits?

An exciting long-range possibility is to use zeolites to store and transport new, environmentally friendly fuels such as hydrogen. Current applications include the following:

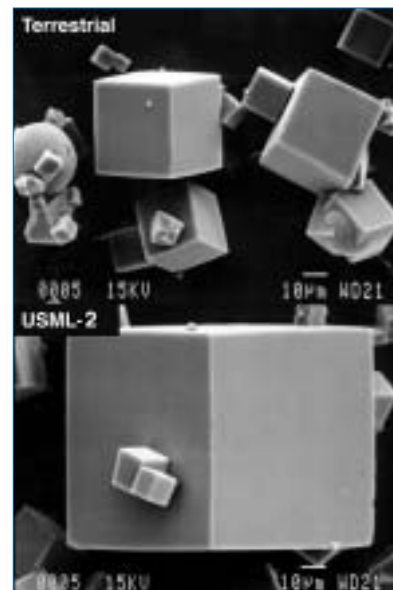
- petroleum and petrochemical processing;
- animal feed supplements, decontamination of radioactive wastes, and a range of household products such as air-fresheners, kitty litter, and laundry detergents;
- air and water filters that help clean up the environment; and
- fillers for composite paper, rubber, plastics, or ceramics, and specialty lightweight ceramic and concrete products.

### What is next?

When enough is known about how to manipulate both the nucleation and growth of zeolites, CAMMP can custom-design them for specific applications and reduce production costs and pollution. CAMMP plans to target zeolite membranes toward reactions—*isomerization, dehydrogenation, and desulfurization*—that are critical to the worldwide processing of petroleum and petrochemical products. In addition, novel applications are being developed to use zeolite membranes to separate and purify gases and liquids for pollution control.

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PHYSICAL SCIENCES RESEARCH  
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SPACE PRODUCT DEVELOPMENT



Zeolite crystals grown on Earth (top) are smaller than those grown by Dr. Sacco on the Space Shuttle in 1994. What appears to be solid blocks are quite porous, as illustrated by the drawing (below). Understanding the exact atomic structure and how to control it are keys to tailoring zeolites to a wider range of uses.

